REMARKS

Claims 1-30 are pending in the present application. Claims 1, 4, 11, 14, 21, 22, and 25 are amended. Support for amendments to claims 1, 11, 21, and 22 is located at least on page 3, lines 3-13, page 15, lines 8-11, page 17, lines 7-22, and page18, lines 10-30. Claims 4, 14, and 25 are amended into independent form including all of the limitations of the base claim and intervening claims to place these claims in condition for allowance. Reconsideration of the claims is respectfully requested.

I. Telephone Interview

Applicants thank Examiner Nasser Moazzami for the courtesies extended to Applicants' representatives during the February 28, 2006 telephone interview. During the interview, Applicants' representatives discussed the distinctions between the specification and the *Yamamoto* and *Horn* references. Specifically, the content and interpretations of claims 1, 2, and 22 were discussed. The substance of the telephone interview is included in the following remarks.

II. Allowable Subject Matter

The Office Action states that claims 4, 14 and 25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. In response, the claims have been rewritten to overcome this objection.

III. 35 U.S.C. § 102, Alleged Anticipation Based on *Yamamoto*

The Office Action rejects claims 1-3, 5-13, 15-24 and 26-30 under 35 U.S.C. § 102(b) as being anticipated by *Yamamoto et al.* (US Patent No. 2001/0023463), hereinafter referred to as *Yamamoto*. This rejection is respectfully traversed.

As to independent claims 1, 11, 21, and 22, the Office Action states:

> As per claims 1, 5-6, and 10, Yamamoto discloses a method of reading data from a mirrored logical volume, comprising: receiving a read request directed to a mirrored logical volume; retrieving characteristic information for each of the plurality of physical storage devices associated with mirrors of the mirrored logical volume; applying one or more rules to the characteristic information to select a physical storage device from the plurality of physical storage devices to which the read request is to be directed; and reading the data from the selected physical storage device **[I/O read requests from the host system are received and assigned to one of the logical units. Selection may be made on a round-robin basis, or any other basis that achieves a desired distribution (page 1, paragraph 0007); selection of the physical disk based on the smallest number of pending requests (page 1, paragraph 0008-0009); logical volumes 32 (Fig. 1); various method for distributing the read requests (paragraph 0025); a**

> **determination is made of which physical disk should be selected (page 2, paragraph 0027); also see page 3, paragraph 0034-0036 and page 4, paragraph 0042-0044; checking to see if the load of the selected disk is appropriate (page 4, paragraph 0048-0049)]. ...**
>
> As per claims 11-13, 15-24, 26-30, claims 11-13, 15-24 and 26-30 encompass the same scope of the invention as those of claims 1-3, and 5-10 in addition of a computer program product in a readable medium for reading data and means for performing the method steps. Therefore, claims 11-13, 15-24 and 26-30 are rejected for the same reasons as stated above with respect to claims 1-3, and 5-10.

Office Action dated December 8, 2005, pages 2-4.

As amended, claim 1, which is representative of the other rejected independent claims 11 and 21 with regard to similarly recited subject matter, reads as follows:

> 1. A method of reading data from a mirrored logical volume, comprising:
>
> receiving a read request directed to a mirrored logical volume;
>
> retrieving characteristic information for each of a plurality of physical storage devices associated with mirrors of the mirrored logical volume, wherein the characteristic information identifies a particular characteristic of a physical storage device itself and wherein the characteristic information distinguishes between different types of physical storage devices in the plurality of physical storage devices;
>
> applying one or more rules to the characteristic information to select a physical storage device from the plurality of physical storage devices to which the read request is to be directed; and
>
> reading the data from the selected physical storage device. (emphasis added)

As amended, claim 22 reads as follows:

> 22. A method, in a data processing system, for selecting a storage device from which to read data, comprising:
>
> storing information into a user input database, wherein the information identifies physical characteristics of at least one storage device itself, and wherein the information distinguishes between the at least one storage device and different storage devices in a plurality of storage devices;
>
> reading, by a device driver, upon mirror activation and initialization, the information for the at least one storage device in the user input database; and
>
> selecting an optimal storage device to send a read request to based upon the information for the at least one storage device read from the user input database. (emphasis added)

A prior art reference anticipates the claimed invention under 35 U.S.C. § 102 only if every element of a claimed invention is identically shown in that single reference, arranged as they are in the claims. *In re Bond*, 910 F.2d 831, 832, 15 U.S.P.Q.2d 1566, 1567 (Fed. Cir. 1990). All limitations of the claimed invention must be considered when determining patentability. *In re Lowry*, 32 F.3d 1579, 1582, 32 U.S.P.Q.2d 1031, 1034 (Fed. Cir. 1994). Anticipation focuses on whether a claim reads on the product or process a prior art reference discloses, not on what the reference broadly teaches. *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 U.S.P.Q. 781 (Fed. Cir. 1983). Applicants respectfully submit that *Yamamoto* does not identically show every element of the claimed invention arranged as they are in the claims. Specifically, *Yamamoto* does not teach or suggest "retrieving characteristic information for each of a plurality of physical storage devices associated with mirrors of the mirrored logical volume, wherein the characteristic information identifies a particular characteristic of a physical storage device itself and wherein the characteristic information distinguishes between different types of physical storage devices in the plurality of physical storage devices," as recited in claims 1, 11, and 21 and *Yamamoto* does not teach or suggest "storing information into a user input database, wherein the information identifies physical characteristics of at least one storage device itself, and wherein the information distinguishes between the at least one storage device and different storage devices in a plurality of storage devices," as recited in claim 22.

Yamamoto is directed toward a storage system that stores multiple copies of data on physical storage implemented, for example, with multiple disk units. Input/output read requests are received from host systems and distributed in a manner that allows parallel read operations to be conducted over the multiple disk units of the physical storage. See *Yamamoto*, Abstract. *Yamamoto* does not teach or suggest "retrieving characteristic information for each of a plurality of physical storage devices associated with mirrors of the mirrored logical volume, wherein the characteristic information identifies a particular characteristic of a physical storage device itself and wherein the characteristic information distinguishes between different types of physical storage devices in the plurality of physical storage devices," as recited in claims 1, 11, and 21. In addition, *Yamamoto* does not teach or suggest "storing information into a user input database, wherein the information identifies physical characteristics of at least one storage device itself, and wherein the information distinguishes between the at least one storage device and different storage devices in a plurality of storage devices," as recited in claim 22.

The Office Action refers to the following portions of *Yamamoto* in the rejection of independent claims 1, 11, 21, and 22:

> [0007] According to one embodiment of the invention, I/O read requests from the host systems are received and assigned to one of the logical storage units and, thereby, to the corresponding physical disk storage. Selection of a logical storage unit for assignment of an I/O read request is preferably made in a manner that distributes I/O read requests among the logical storage units and, thereby, the corresponding physical storage areas. For example, selection may be made on a round-robin basis, or any other basis that achieves a desired distribution among the logical storage units. In this manner, read requests are distributed over the areas of physical storage containing the multiple copies of the data requested.
>
> [0008] In an alternate embodiment of the invention, I/O read requests are not immediately assigned to a logical unit. Rather, all the logical units are mapped to their matching physical discs maintaining the copies of the data of the I/O read request, and those physical disk storage areas examined for selection. For example, the physical disk

> with the smallest number of pending requests may be selected, and the I/O read request is assigned to the logical storage unit corresponding to that selected physical storage.
>
> [0009] In a further embodiment of the invention, when an I/O read request is received, a number of the logical units, less than all, are mapped to their corresponding physical storage containing the requested data. The physical disks making up that physical storage are then reviewed to select, for example, the one with a small backlog of pending requests, and the I/O read request is assigned to the logical storage unit corresponding to the selected physical storage.

Yamamoto, page 1, paragraphs 0007-0009.

> [0027] In a second variation, the method of the present invention will first perform the logical-physical mapping of all logical volumes 32 to obtain all the addresses of the data sought by the request in the physical storage 14. Then, a determination is made of which physical disk unit should be selected. For example, that selection may be based upon how many outstanding requests each physical disk has, and the I/O read request then assigned to the logical volume 32 corresponding to that selected disk unit 16.

Yamamoto, page 2, paragraph 0027.

> [0048] Step 162 checks the processing request 72 of the selected physical disk 16 to determine if the "load" of the selected physical disk is appropriate; that is, if the processing request 72 is within a predetermined parameter (e.g., what ?). If so, step 162 will exit in favor of step 164 in which the load distribution process 150 will pass the I/O read request to the read request disk issue process 100 (FIG. 7) in order to access the data and initiate the steps necessary to pass that data to the requesting processor system 12. The load distribution process 150 will then terminate at step166.
>
> [0049] If, however, step 162 determines that the load condition of the selected physical disk unit 16 is not within an acceptable parameter, step 162 will be exited in favor of determining, in step 170, whether or not a less restrictive load condition is needed. If so, in step 172, the load condition restriction is made more liberal, and the load distribution process 150 returns to step 152 to again locate the data on a physical disk whose load is now within the modified load condition parameter.

Yamamoto, page 4, paragraphs 0042-0044 and 0048-0049.

These portions of *Yamamoto* teach that the selection of a logical storage unit for the assignment of an I/O read request is preferably made in a manner that distributes I/O read requests among the logical storage units. *Yamamoto* determines whether or not the load condition of the selected physical disk unit is within an acceptable parameter. Specifically, *Yamamoto* is directed to load balancing. *Yamamoto* does not teach or suggest "retrieving characteristic information for each of a plurality of physical storage devices associated with mirrors of the mirrored logical volume, wherein the characteristic information identifies a particular characteristic of a physical storage device itself and wherein the characteristic information distinguishes between different types of physical storage devices in the plurality of physical storage devices," as recited in claims 1, 11, and 21. In addition, *Yamamoto* does not teach or suggest "storing information into a user input database, wherein the information identifies physical characteristics of at least one storage device itself, and wherein the information distinguishes between the at least one storage device and different storage devices in a plurality of storage devices," as recited in claim 22.

In view of the above, Applicants respectfully submit that *Yamamoto* does not teach each and every feature of independent claims 1, 11, 21, and 22, as is required under 35 U.S.C § 102(b). In addition, *Yamamoto* does not teach each and every feature of dependent claims 2-3, 5-10, 12-13, 15-20, and 23-30 at least by virtue of their dependency on claims 1, 11, and 22, respectively. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 1-3, 5-13, 15-24, and 26-30 under 35 U.S.C § 102(b).

In addition to the above, *Yamamoto* does not teach the specific features recited in dependent claims. With respect to claims 2, 12, and 23, *Yamamoto* does not teach or suggest wherein the characteristic information includes at least one of whether a corresponding physical storage device includes a write cache, whether a corresponding physical storage device includes a read-ahead cache, a speed of a corresponding physical storage device, and a connection type of a corresponding physical storage device. The cited portion of *Yamamoto* does not refer to the speed, such as RPM, of a corresponding physical storage device.

IV. 35 U.S.C. § 102, Alleged Anticipation Based on *Horn*

The Office Action rejects claims 1-3, 5-13, 15-24 and 26-30 under 35 U.S.C. § 102(e) as being anticipated by *Horn et al.* (US Patent Application Number 2004/0034751), hereinafter referred to as *Horn*. This rejection is respectfully traversed.

As to independent claims 1, 11, 21, and 22, the Office Action states:

> As per claims 1, Horn discloses a method of reading data from a mirrored logical volume, comprising: receiving a read request directed to a mirrored logical volume; retrieving characteristic information for each of the plurality of physical storage devices associated with mirrors of the mirrored logical volume; applying one or more rules to the characteristic information to select a physical storage device from the plurality of physical storage devices to which the read request is to be directed; and reading the data from the selected physical storage device [**data is mirrored (page 1, paragraph 0005); determining the storage volume cost (page 2, paragraph 0018); determining the path cost (page 2, paragraph 0019); using the results of storage volume cost and path cost to determine the storage volume access (page 2, paragraph 0020)**]. ...
>
> As per claims 11-13, 15-24, 26-30, claims 11-13, 15-24 and 26-30 encompass the same scope of the invention as those of claims 1-3, and 5-10 in addition of a computer

> program product in a readable medium for reading data and means for performing the method steps. Therefore, claims 11-13, 15-24 and 26-30 are rejected for the same reasons as stated above with respect to claims 1-3, and 5-10.

Office Action dated December 8, 2005, pages 4-6.

Applicants respectfully submit that *Horn* does not identically show every element of the claimed invention arranged as they are in the claims. Specifically, *Horn* does not teach or suggest "retrieving characteristic information for each of a plurality of physical storage devices associated with mirrors of the mirrored logical volume, wherein the characteristic information identifies a particular characteristic of a physical storage device itself and wherein the characteristic information distinguishes between different types of physical storage devices in the plurality of physical storage devices," as recited in claims 1, 11, and 21 and *Horn* does not teach or suggest "storing information into a user input database, wherein the information identifies physical characteristics of at least one storage device itself, and wherein the information distinguishes between the at least one storage device and different storage devices in a plurality of storage devices," as recited in claim 22.

Horn is directed toward a network storage system that includes a network storage system controller/virtualizer, which includes at least one transaction processor. When a host access request is received by the network storage system controller/virtualizer, the transaction processor calculates one or more cost functions. A cost function associated with storage system volume load and a cost function associated with communication path load are calculated. The cost function result(s) are utilized by the storage system controller/virtualizer to form a request for servicing the host access request while balancing the load of the network storage system. See *Horn*, Abstract. *Horn* does not teach or suggest "retrieving characteristic information for each of a plurality of physical storage devices associated with mirrors of the mirrored logical volume, wherein the characteristic information identifies a particular characteristic of a physical storage device itself and wherein the characteristic information distinguishes between different types of physical storage devices in the plurality of physical storage devices," as recited in claims 1, 11, and 21. In addition, *Horn* does not teach or suggest "storing information into a user input database, wherein the information identifies physical characteristics of at least one storage device itself, and wherein the information distinguishes between the at least one storage device and different storage devices in a plurality of storage devices," as recited in claim 22.

The Office Action refers to the following portions of *Horn* in the rejection of independent claims 1, 11, 21, and 22:

> [0005] In conventional architectures, computer data is mirrored or striped across the available storage volume resources, and the networked storage system controller/virtualizer maintains the indexing or addressing information necessary to maintain the data integrity, data synchronization, and read and write data across the

> mirrored or striped storage volumes. Conventional networked storage system architectures focus on providing enough data protection to ensure that networks can suffer high levels of storage volume degradation without loss of data. However, one of the limitations to this configuration is the necessity of trading-off cost and performance. While networked storage system architectures protect storage volume integrity, they do not necessarily provide any performance optimization methods for storage volume and communication channel utilization. This means that when the networked storage system controller/virtualizer receives commands, little or no consideration is given to efficient and speedy routing and retrieval of the data based on load balancing.

Horn, page 1, paragraph 0005.

> [0018] The storage volume load balance cost algorithm 230 is a code segment executed in MC 210 that determines the storage volume cost based on many factors, including the number of commands that are being processed per storage volume, the weight or size of each command, how many sectors have been requested for each storage volume, the current drive workload, the stripe size for each mapping, and the status of the mapping. Weighting factors are programmable on a per volume basis. Cost algorithm 230 determines the appropriate storage volume(s) to access to process CMD 205 while maintaining the desired storage volume and path workload balance. Storage volume load balance cost algorithm 230 is performed on read command requests only.
>
> [0019] The path load balance cost algorithm 231 then determines the path cost based on several factors, including the number of commands per path, the weight or size of each command, and the number of sectors per path. Weighting factors are programmable on a per volume basis. Cost algorithm 230 determines the appropriate path to use to process CMD 205 while maintaining the desired storage volume and path workload balance. Path load balance cost algorithm 231 is performed on both read and write command requests.
>
> [0020] Storage volume load balance cost algorithm 230 and path load balance cost algorithm 231 then return cost algorithm results 235. MC 210 then uses results 235 to determine the storage volume access commands required to service CMD 205. The results are then sent as storage volume access command 245 for use by other functional blocks of integrated transaction processor 122 in continued execution of CMD 205.

Horn, page 2, paragraphs 0018-0020.

These portions of *Horn* teach determining an appropriate storage volume to access to maintain the desired storage volume load balance and path workload balance using cost algorithms. The cost algorithms are performed on read and write command requests. *Horn* does not teach or suggest "retrieving characteristic information for each of a plurality of physical storage devices associated with mirrors of the mirrored logical volume, wherein the characteristic information identifies a particular characteristic of a physical storage device itself and wherein the characteristic information distinguishes between different types of physical storage devices in the plurality of physical storage devices," as recited in claims 1, 11, and 21. In addition, *Horn* does not teach or suggest "storing information into a user input database, wherein the information identifies physical characteristics of at least one storage device itself, and wherein the information distinguishes between the at least one storage device and different storage devices in a plurality of storage devices," as recited in claim 22.

In view of the above, Applicants respectfully submit that *Horn* does not teach each and every feature of independent claims 1, 11, 21, and 22, as is required under 35 U.S.C § 102(e). In addition, *Horn* does not teach each and every feature of dependent claims 2-3, 5-10, 12-13, 15-20, and 23-30 at least by virtue of their dependency on claims 1, 11, and 22, respectively. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 1-3, 5-13, 15-24, and 26-30 under 35 U.S.C § 102(e).

In addition to the above, *Horn* does not teach the specific features recited in dependent claims. With respect to claims 2, 12, and 23, *Horn* does not teach or suggest wherein the characteristic information includes at least one of whether a corresponding physical storage device includes a write cache, whether a corresponding physical storage device includes a read-ahead cache, a speed of a corresponding physical storage device, and a connection type of a corresponding physical storage device. The cited portion of *Horn* does not refer to the speed, such as RPM, of a corresponding physical storage device or a connection type, such as USB, firewire, or fibrechannel, of a corresponding physical storage device. *Horn* only mentions that in conventional networked storage system architecture there are several storage volumes connected with several communication channel options, such as FibreChannel Arbitrated Paths and that all paths are dedicated data communications means, such as FibreChannel Arbitrated Paths.

V. Conclusion

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance. The Examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the Examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

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Respectfully submitted,

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